SE Response to Acquisition Challenges

NASA PM Challenge Workshop

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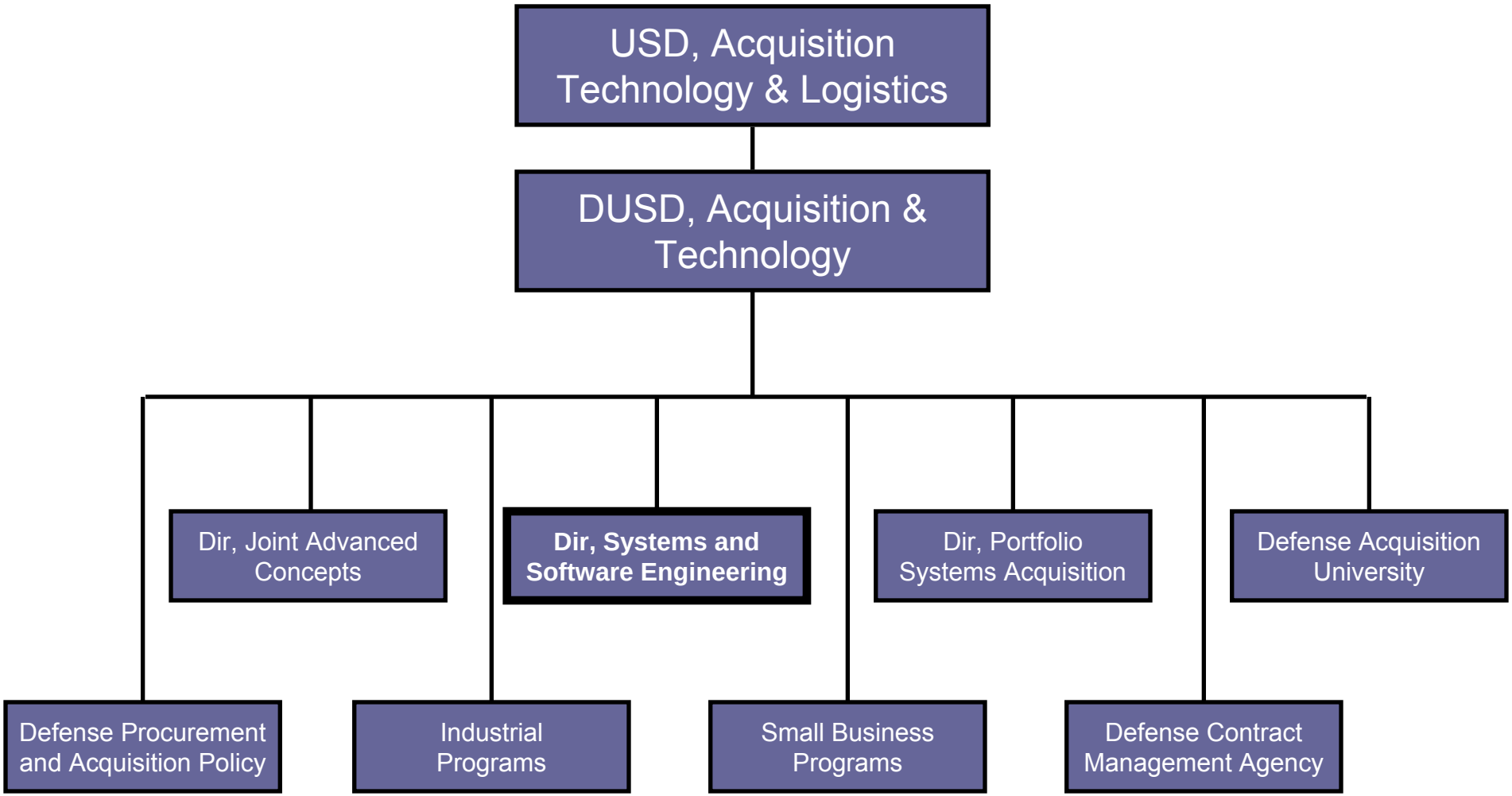
AT&L Organization



System and Software Engineering (SSE) Vision / Mission

- Vision: Systems engineering principles and disciplines are fully accepted and assimilated into the DoD acquisition workforce positioning the DoD for acquisition excellence leading to a stronger national defense

- Mission:
  - Provide flexible systems engineering acquisition policy, guidance, and training to the DoD acquisition workforce.
  - Foster an acquisition environment of collaboration, teamwork, and joint ownership of program success through a proactive program oversight process ensuring appropriate levels of systems engineering are applied through all phases of program development.
  - Engage all stakeholders across government, industry, and academia to collectively achieve acquisition excellence.

SSE Responsibilities

- Provide Independent Technical Advice to the USD(AT&L):
  - Program Support Reviews and Assessments
  - Systemic Analysis of Data Collected across programs
- Acquisition Documentation Authority:
  - Systems Engineering Plan (SEP)
  - Test and Evaluation Master Plan (TEMP)
  - Program Protection Plan (PPP)
- Acquisition Policy and Guidance Leadership:
  - ☆ Systems Engineering ☆ Modeling & Simulation ☆ System Assurance
  - ☆ Test & Evaluation ☆ Energy ☆ Cyber Security
  - ☆ Software Engineering ☆ Safety & HSI ☆ Risk Management
- Defense Acquisition Workforce Career Field Manager:
  - Systems Planning Research, Development and Engineering
  - Test and Evaluation
  - Production Quality Management
- SE Research University Affiliated Research Center Co-Sponsor

Key OSD SE Improvement Areas - Transcending DoD Acquisition

- System/Software Engineering Integration
  - Framework to highlight key process, workforce, and tools to recognize key role software plays in our systems
- Systems of Systems Engineering
  - *DoD SoS SE Guide* defines core elements of SoS SE, application of SE processes, and emerging principals
- Integrated Development and Operational Testing
  - Realistic DT and shared data to allow early OT insights, and potential reduction in OT test points
- Manufacturing and Reliability
  - Setting reliability growth goals and assessing manufacturing readiness throughout the lifecycle
- System Assurance and Program Protection
  - *NDIA Engineering for Assurance Guidebook* integrates security & Systems Engineering to address tampering and network threats

Acquisition Challenges

- Specific Causes of Program Failure as identified in DoD Systemic Root Cause Analysis findings

We do not start programs right

- Insufficient requirements analysis and definition at program initiation
- Lack of rigorous SE approach
- Optimistic/realistic reliability growth – not a priority during development
- Inadequate software architectures, design, development discipline, and organizational competencies

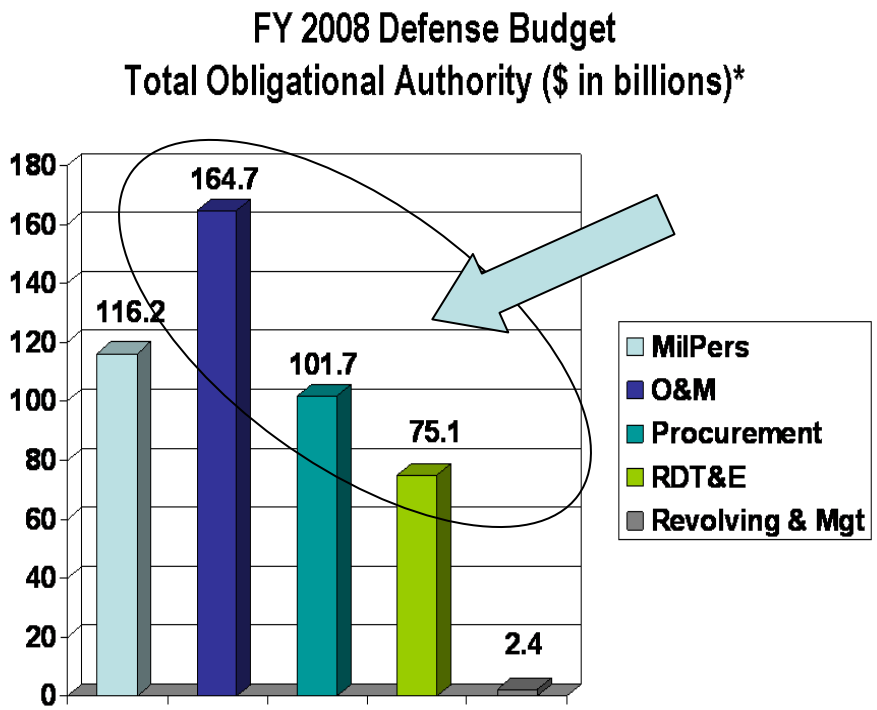
We do not manage programs right

- Insufficient trade space
- Insufficient risk management
- Inadequate IMP, IMS, EVMS
- Most programs lack quantifiable entrance/exit criteria
- Maturing "suitability" (e.g., RAM) is not always a priority

Reality and the Opportunity

- Acquisition cost growth over 11 years*:
  - Estimation changes: $201B
  - Engineering changes: $147B
  - Schedule changes: $70B

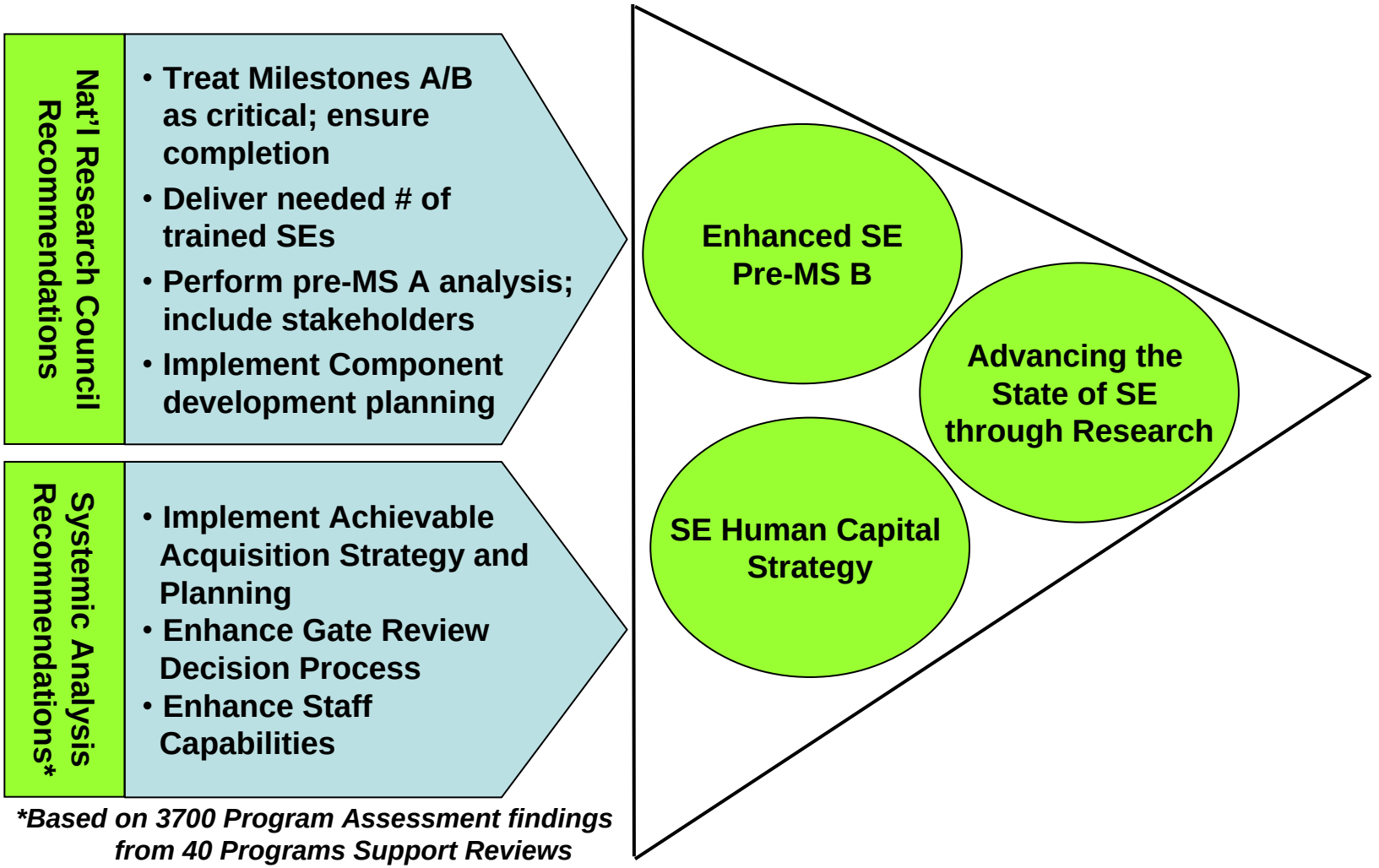
**SAR data FY 1995–2005*



*National Defense Budget for FY 2008 (aka Green Book), March 2007, page 29.

With 72% of O&S costs established pre-Milestone A, Systems Engineering plays a critical role ensuring capabilities are translated into executable requirements and feasible programs

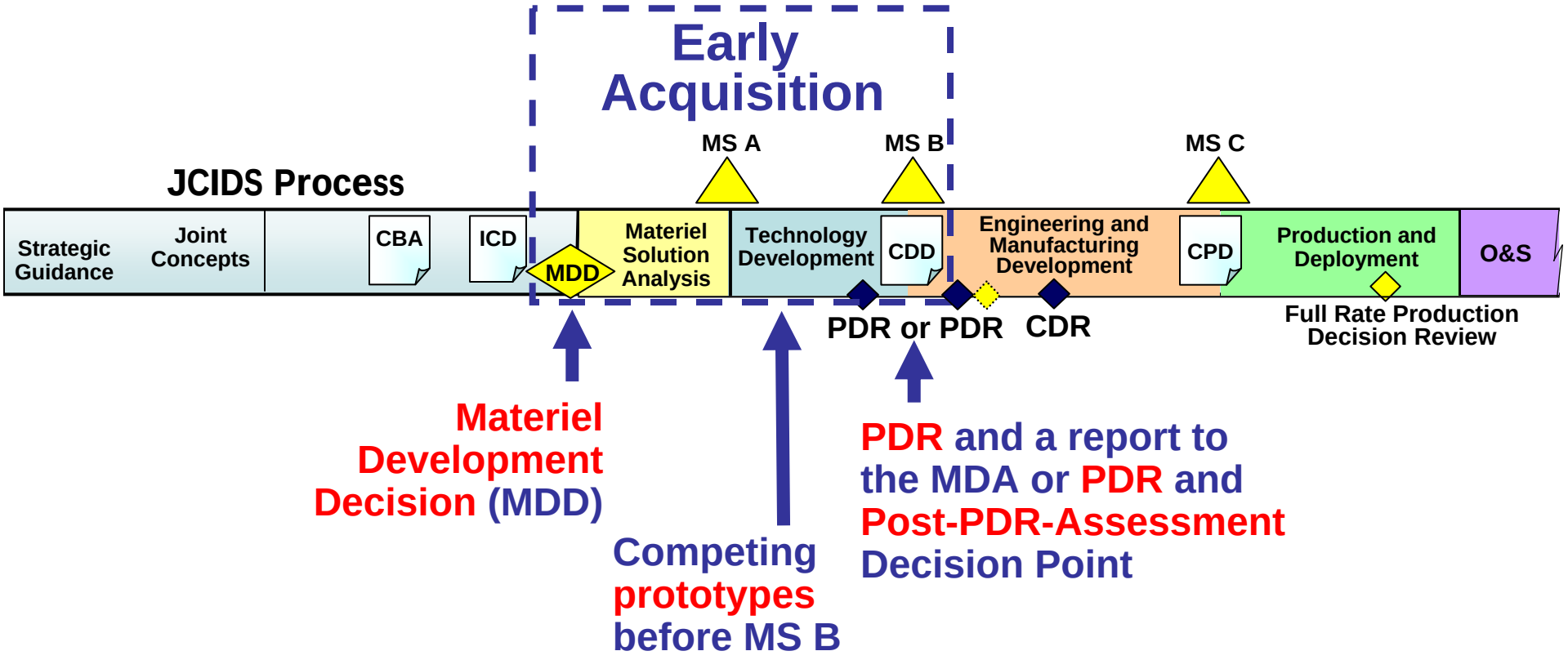
OSD SE Strategy



Based on 3700 Program Assessment findings from 40 Programs Support Reviews

Enhancing Systems Engineering Engagement with Programs Early in the Acquisition Lifecycle

New DoD Acquisition Policy: Increased Focus on Early Acquisition



- What are the implications of these changes for programs?
- How can systems engineering enable the program during this early phase?

Why is this challenging?

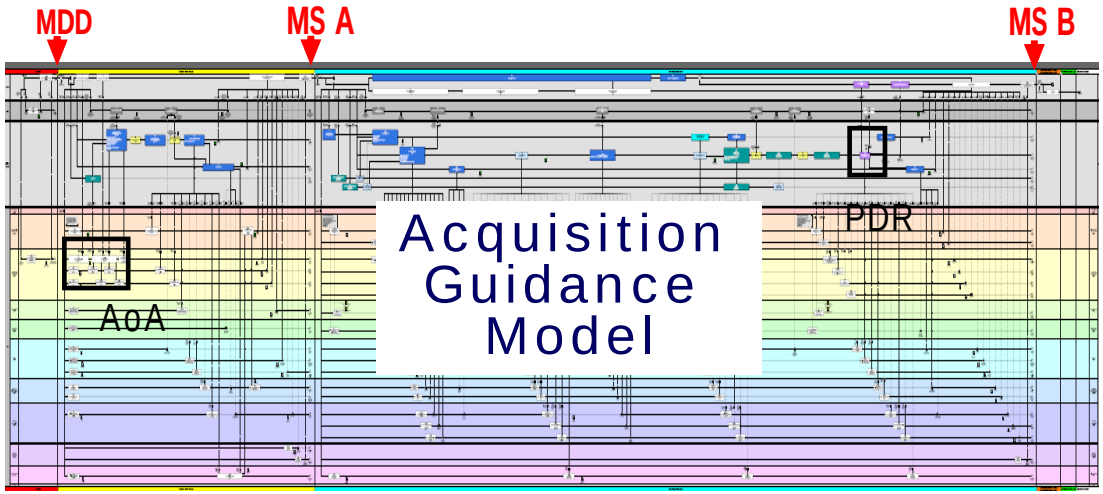
- Very little experience with current pre-Milestone B SE activities
  - Makes it difficult to know what to 'adjust' given changes
- The acquisition guidance is voluminous
  - Online resource with over 500 printed pages of information without hotlinks
- Limited understanding about interdependencies within the guidance provided to the program from different perspectives (contracting, costing, etc.)
- For SE to be an effective enabler, we need to understand the activities, products, and their integration with the program

PM Challenges

- Early acquisition Program Office and Staff resources
- Preparing a strategy for technology development
- Funding implications (shifting resources from post MS B to Pre-MS A)
- Contracting strategies for studies, analyses, prototyping
- Early engagement with industry to identify and burn down risks
- Tailoring procedures to specific domains and/or complexity

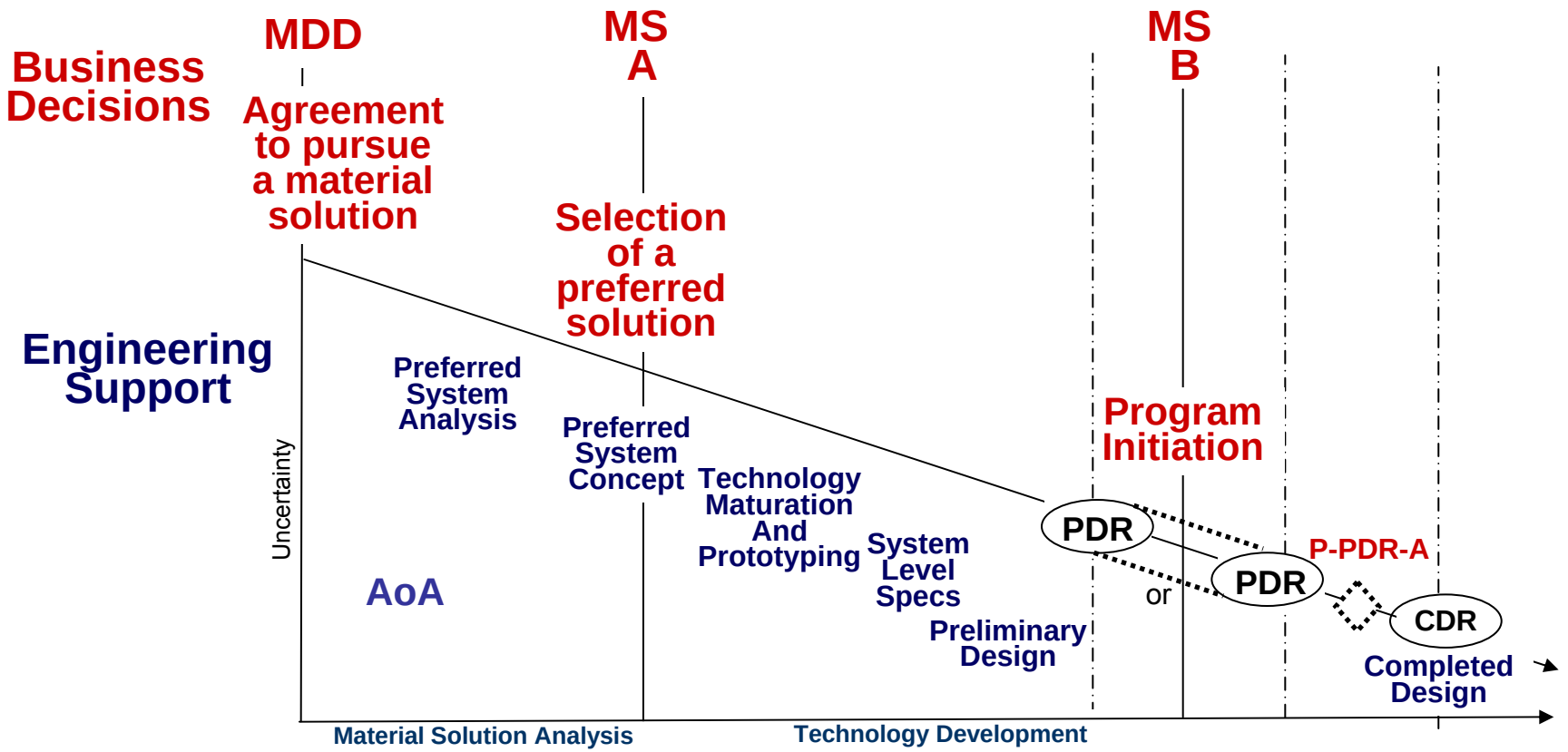
Way Ahead

- Conducting workshops with PMs approaching MS A to help them understand how the new 5000 applies to them
- Updating our Guidebook to include a section describing how PMs incorporate Systems Engineering
  - To augment guidance on what systems engineering is
- Building an Acquisition Guidance Model as a tool to help integrate program acquisition activities



Best viewed as 4' x 10' version

Enhanced SE Engagement



Make acquisition decisions when you have solid evidence and acceptable risk

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The Need

- Current SE methods, processes, tools do not address the breadth, complexity, and tempo of today's development environment.
- Although systems engineering is recognized as key to delivering weapon systems, there is no single body leading the effort to advance SE methods, processes, and tools (MPTs) to support DoD challenges…nor funding line.
- There is an inadequate supply of systems engineers experienced with the breadth and complexity of DoD's current development environment.

SER UARC Mission:

To research and analyze advanced and emerging systems engineering practices and relevant technologies to address the full spectrum of DoD and Intelligence systems across the Department

SERC Research Strategy

1. **Enterprise Responsiveness:** Explore advancements in SE methods, processes, and tools that are responsive to enterprise strategic and program-level needs, enabling agility and responsiveness to change during program conceptualization and execution as well as strategic choice and assessment.
2. **Systems Science and Complexity:** Advance systems science and systems thinking for application to engineering and management of complex systems and capabilities.
3. **Human Capital:** Explore future workforce competencies and approaches to cultivate, educate, and prepare the future SE workforce.
4. **Program and SE Integration:** Research the promotion and integration of SE methods, processes, and tools with program execution activities.
5. **Life Cycle Systems Engineering Processes:** Advance system engineering life cycle technical and management processes.

Far Reaching Benefits

- UARC will address SE research challenges across DoD and the Federal Government
- Research results (new/improved MPTs) will be shared across Government and industry to improve SE practice.
- Opportunity for leveraged investment
  - Advance the state of Systems Engineering
  - Nurture and grow graduate-level systems engineering academic and research programs

Questions?